Unmanned Aircraft Systems: History of the Technology and Uses in Site Investigations, Surveying and Other Environmental Applications

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Background/Objectives. Use of unmanned aircraft systems (UAS) goes all the way back to 1800s, with a long history of use in defense applications. Continuous technology innovations have made their way into application in small UAV design. Smaller, more accurate sensors, lighter stronger materials, faster processing units, and battery weight to energy improvements, have all contributed to today's practical design and application of these vehicles.

This presentation will cover a brief history of UAV technology, past and current applications, the current state of UAVs and their use environmental applications, as well as review of three use applications.

Approach/Activities. Several useful applications have emerged for UASs in the environmental field. Aerial datasets collected are processed into Orthomosaics that can be converted into slope-grade models, contours, volumetric surveys, and photogrammetry that engineers and site managers can use to make land management decisions. Base line Orthomosaics can also be compared to newer data sets to analyze land changes related to contaminated sites and cleanup efforts.

In June of 2016, Geotech supported a joint-effort program to determine if UASs could be used for inspecting Elephant Butte Dam. The data collected were used to build a georeferenced photogrammetric 3-D model, topographical map, and 3-D printed model. This presentation outlines the project scope and lessons learned.

In 2017, Geotech used a UAS to capture images over a bog to identify the source of a spring. The source of the spring was verified using a flir infrared lens attached to a quadcopter, and comparing the thermal data of the site.

Also in 2017, a spectrometer was used to fly over an unconfirmed geologic feature on a preserved site for the nature conservancy. The spectrometer detected the mounds were heavily composed of iron, confirming a theory that the features were ancient stramatolites.

Results/Lessons Learned. A variety of useful data sets were generated from these UAS operations. Development of field operations and data processing, procedures have led to; repeatable quality of collected data and reliable processing timelines.

Additionally, there were several process improvements gained from the use of UAS in these environmental applications. These will be discussed along with ways that the information derived from UAS can facilitate improved decision-making and site management by providing information not previously available.